

Lab next class - hand back tests after the lab

Quiz Feb 22nd Chapter 12

Test Thermal and Nuclear physics March 8th - field trip
students come in collab time March 6th.

Nuclear Physics Ch 30, 31

Define: Atom, nucleus, proton, neutron, electron,
quark, neutrino, isotope element, atomic number,
atomic mass number, isotopic mass

Homework, Q16 p255

Big idea:

heat lost by the metal = heat gained by the water

a) $Q = mH_F$

$$= 0.175 \times 2.04 \times 10^4 = 3,570.0 \text{ J}$$

heat lost by metal = heat gained by water

$$3570 = 0.055 \times 4180 (T_f - 20)$$

$$T_f - 20 = 3570 / (0.055 \times 4180) = 15.5285$$

$$T_f = 20 + 15.5285 = 35.5285$$

$$T_f = 35.5^\circ\text{C}$$

b)

Q_{metal} = metal cooling = water warming

$$mc\Delta T = mc\Delta T$$

$$-0.175 \times 130 (T_e - 327) = 0.055 \times 4180 (T_e - 35.5285)$$

$$(0.055 \times 4180) + (0.175 \times 130) = 252.65$$

$$(0.055 \times 4180 \times 35.5285) + (0.175 \times 130 \times 327) = 15607.2522$$

$$(0.055 \times 4180) + (0.175 \times 130) = 252.65$$

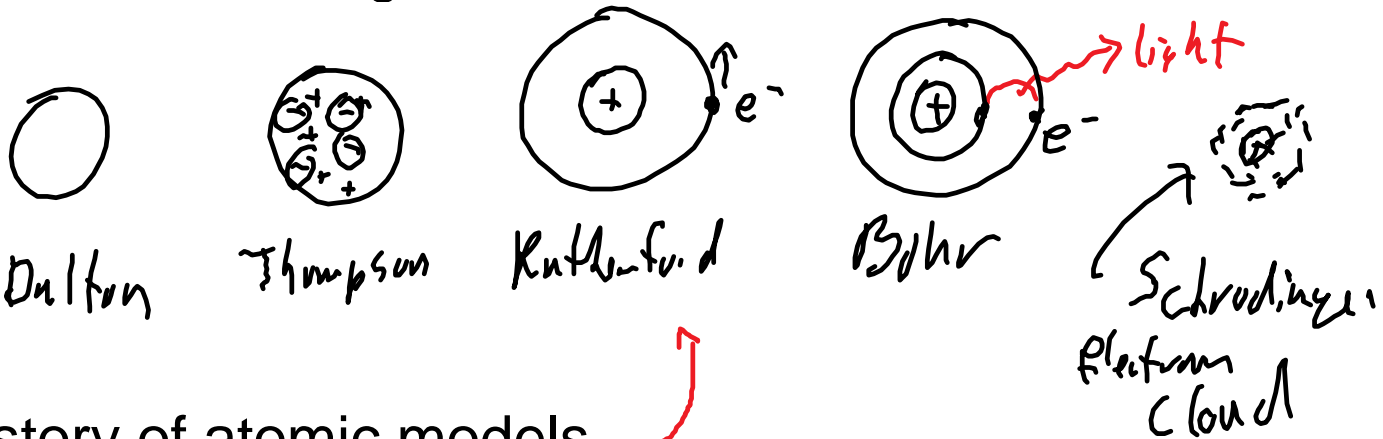
$$(0.055 \times 4180 \times 35.5285) + (0.175 \times 130 \times 327) = 15607.2522$$

$$252.65 T_e = 15607.2522$$

$$T_e = 15607.2522 / 252.65 = 61.7742$$

$$T_e = 61.8^\circ\text{C}$$

Atom - smallest piece of matter that is still an element. made of protons, neutrons (in the nucleus) and electrons orbiting around in a "cloud" called orbitals.



history of atomic models

nucleus: discovered by Rutherford when he shot alpha particles at gold and found some bounced back. He concluded that most of the mass is in a small, positively charged area.

It has the protons and neutrons.

proton - positively charged particles, same charge as an electron but positive. The number of protons

determines the element - chemical properties.

neutron - neutral particles in the nucleus. Discovered by Chadwick to account for mass discrepancy.

electron - negatively charged particles around the nucleus - very small mass $1/10000$ of the proton or neutron - responsible for electrical current

quark - fundamental particles that make up protons and neutrons - have fractional charge

neutrino - highly unreactive neutral particle that is produced in beta decay.

isotope- substances with same number of protons but different number of neutrons. Very similar chemical properties but different nuclear properties.

element - same number of protons

atomic number, Z , the number of protons

atomic mass number, A , the total of the number of protons and neutrons

isotopic mass- mass of a particular isotope

atomic mass is the average mass of a sample of an element.

eg. carbon 12 has 6 protons and mass number 12.
how many neutrons? $12 - 6 = 6$
carbon 14 has 6 protons (carbon) and mass number 14, so it has $14 - 6 = 8$ neutrons.

p618 Q1-4 (nuke)

p263 Q 9, 13, 22 (quiz)

lab next class

Homework, Q16 p255

Hot molten lead, 0.175kg at 327°C the melting point is put in 0.055kg of water at 20°C

a) what is the temperature of the water when the lead is solidified but still at 327°C

for no change in temperature but a change in state, $Q = mH_F = 0.175 \times 2.04 \times 10^4 = 3,570.0 \text{ J}$

the water warms so $Q = mc\Delta T$

$$3570 = 0.055 \times 4180 (T_f - 20)$$

$$(T_f - 20) = 3570 / (0.055 \times 4180) = 15.5285$$

$$T_f = 20 + 15.5 = 35.5^{\circ}\text{C}$$

b) the lead is solid and cools (changes its temperature)

heat lost by the lead = heat gained by the water

$$-Q_{\text{lead}} = Q_{\text{water}}$$

heat lost by the lead = heat gained by the water

$$\begin{aligned} -Q_{\text{lead}} &= Q_{\text{water}} \\ -mc\Delta T &= mc\Delta T \\ -0.175 \times 130 &= 22.75 \quad 0.055 \times 4180 = 229.9 \\ -22.75(T_E - 327) &= 229.9(T_E - 35.5) \end{aligned}$$

$$229.9/22.75 = 10.10549 \quad 10.10549 \times 35.5 = 358.7449$$

$$-T_E + 327 = 10.105T_E - 358.7449$$

$$358.7449 + 327 = 685.7449$$

$$T_E = 685.7449 / (10.105 + 1) = 61.751 = 62^\circ\text{C}$$

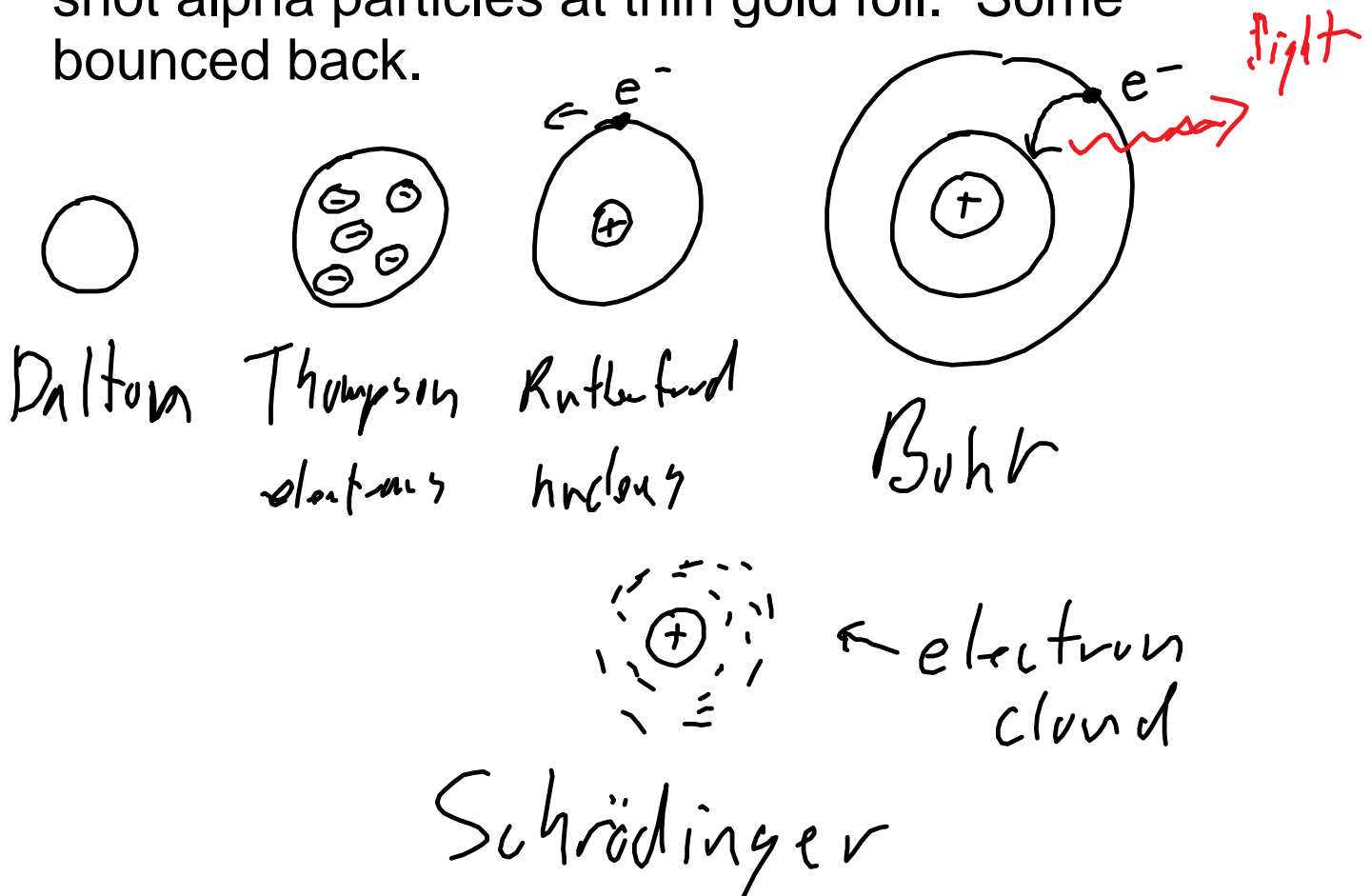
Nuclear Physics Ch 30, 31

Define: Atom, nucleus, proton, neutron, electron, quark, neutrino, isotope element, atomic number, atomic mass number, isotopic mass

Atom - particles that make up everything.
Molecules are built of atoms bonded chemically.
Smallest unit of an element.

element - pure substance on the periodic table
- have the same number of protons in the atomic nucleus as each other.
all hydrogen atoms have 1 proton
all carbon atoms have 6 protons

nucleus is the centre of the atom, most of the mass and is positively charged - neutrons and protons. Discovered by Rutherford when he shot alpha particles at thin gold foil. Some bounced back.



proton - positive sub-atomic particle that makes up the nucleus.

neutron - neutral sub-atomic particle that makes up the nucleus.

electron - negative sub-atomic particle that goes around the nucleus. $1/100000$ th the mass of a proton or neutron.

mass of electron = $9.11 \times 10^{-31} \text{kg}$

mass of proton = $1.67 \times 10^{-27} \text{kg}$

quark - fundamental particles that make up

protons and neutrons.

neutrino - chargeless and highly unreactive particles produced in beta decay.

isotopes - same number of protons, different number of neutrons.

eg. carbon 12 and carbon 14 are isotopes of carbon

atomic number - number of protons in the nucleus
eg. carbon has atomic number 6

atomic mass number is the number of protons+neutrons

carbon 12 has 6 protons and 6 neutrons while carbon 14 has 6 protons and 8 neutrons

isotopic mass - the mass of a particular isotope - physics

atomic mass - is the average of natural occurring isotopes -chem

p618 Q1-4

p263 Q 9, 13, 22

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Nuclear Physics Ch 30, 31

Define: Atom, nucleus, proton, neutron, electron,
quark, neutrino, isotope element, atomic number,
atomic mass number, isotopic mass

Homework, Q16 p255

0.175kg of lead that is molten - liquid - at 327°C
is placed in 0.055kg of water at 20°C

- a) when the lead is solidified, what is the
temperature of the water? no change in
temperature, only in state
- b) when they are in thermal equilibrium, what is
that temperature?

a) $Q = mH_F = 0.175 \times 2.04 \times 10^4 = 3,570.0 \text{ J}$
that energy goes to heat the water
 $Q = mc\Delta T$
 $3570 = 0.055 \times 4180 \times \Delta T$
 $\Delta T = 3570 / (0.055 \times 4180) = 15.5285$

$T_f = 20 + 15.5 = 35.5 \text{ }^\circ\text{C}$

- b) $Q = -Q$
heat gained by the water = heat lost by the

b) $Q = -Q$

heat gained by the water = heat lost by the metal

$$mc\Delta T = -mc\Delta T$$

$$0.175 \times 130 = 22.75 \quad 0.055 \times 4180 = 229.9$$

$$22.75(T_e - 327) = -229.9(T_e - 35.5)$$

$$T_e - 327 = 229.9 / 22.75 = 10.1055 \quad T_e - 10.1055 \times 35.5 = -358.7453$$

$$T_e - 327 = -10.1055 T_e + 358.7453$$

$$11 T_e = 358.7 + 327 = 685.7$$

$$T_e = 685.7 / (11.1055) = 61.7442$$

$$T_e = 62^\circ\text{C}$$

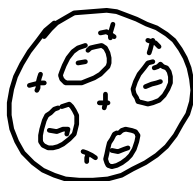
New Chapter - Nuclear physics

Atom - smallest piece of matter that is an element
an atom of hydrogen is the smallest bit of hydrogen that is still hydrogen

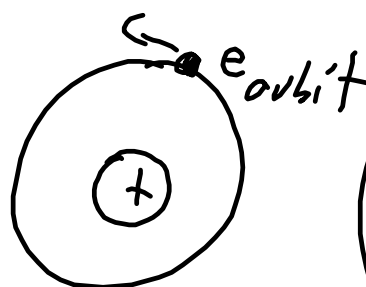
history of atomic models:



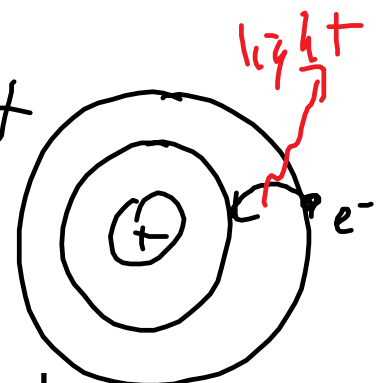
Dalton



Thompson
electron



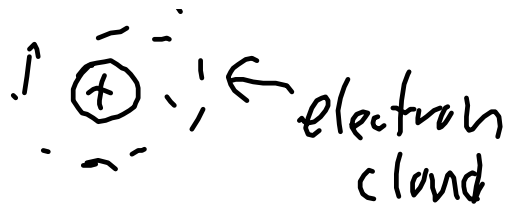
Rutherford
Nucleus



Bohr

energy
levels





Schödinger

- probability cloud
of electrons

element - pure substance on the periodic table - all the atoms have the same number of protons in the nucleus of the atom.

nucleus - Rutherford discovered that if you shoot alpha particles at very thin gold foil, some bounce back. He concluded that there is a very dense, positive portion of the atom, the nucleus.

protons - positive charge, more massive than electrons and exist in the nucleus.

neutrons - neutral charge, more massive than electrons and exist in the nucleus.

quarks - fundamental particles, that make up protons and neutrons. Have a fraction of the proton/electron charge.

neutrino - highly unreactive neutral particle that is produced in some nuclear reactions, like beta decay. Neutrinos are very hard to detect.

isotopes - same number of protons but different number of neutrons - carbon 12 and carbon 14 are isotopes.

Carbon has atomic number 6 , so it has 6 protons.

carbon 12 has atomic mass number 12, so it has 6 protons and 6 neutrons.

carbon 14 has atomic mass number 14, so it has 6 protons and 8 neutrons

atomic mass number is the number of protons+neutrons

atomic number = number of protons

isotopic mass = mass of the isotope

p 618 Q1-4

p 263 Q9, 13, 22 - for the quiz

